

PATENTS

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE** #3

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10-1-01  
Ratkins

**Applicant(s):** Junko Kohno, et al.

**Docket:** 12516Z

**Serial No:** unassigned

**Dated:** April 11, 2001

**Filed:** Herewith

**For:** SEMICONDUCTOR DEVICE AND  
METHOD FOR MANUFACTURING SAME

Assistant Commissioner for Patents  
United States Patent and Trademark Office  
Washington, D.C. 20231

**PRELIMINARY AMENDMENT**

Madam:

This preliminary amendment is directed to the above-identified Continuation Patent Application filed on April 11, 2001. Prior to examination, please amend the application as follows:

**In the Specification:**

**Please amend the specification as follows:**

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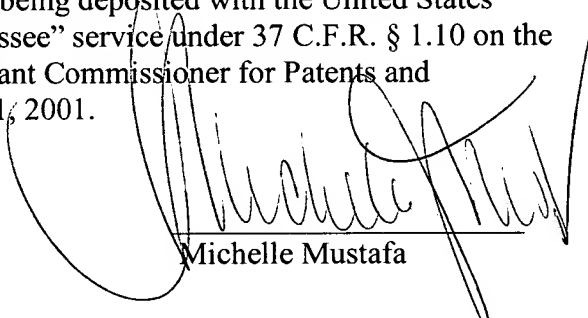
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Dated: April 11, 2001

  
Michelle Mustafa

Please insert the following paragraph immediately following the title:

*A'* ~CROSS REFERENCE TO RELATED APPLICATIONS

This application is a continuation application of U.S. Patent Application No.

09/266,652 filed on March 11, 1999.~

Please replace the paragraph beginning on page 14, line 1 with the following rewritten paragraph:

*A<sup>2</sup>* ~ The active element and the package, prepared as described above, are positioned so that the source electrode 4 of the active element faces/abuts to the Au plating 11 on the heat sink 9 of the package, and the active element and the package are bonded to each other by thermal pressure bonding for mounting, leaving a void 14 between the Au plating 11 and the Aluminum nitride 5, as show in Fig. 9.~

Please replace the paragraph beginning on page 15, line 15 with the following rewritten paragraph:

*A<sup>3</sup>* --The active element and the package, prepared as described above, are positioned so that the source electrode 4 of the active element faces the Au plating 11 on the heat sink 9 of the package, and so that the drain electrode 3 faces the aluminum nitride 5, leaving a void 14 between the Au plating and the aluminum nitride 5. In this state, the active element and the package are bonded to each other by thermal pressure bonding for mounting, as shown in Fig. 9. -

In the Claims:

✓  
Please cancel claims 1, 2, 4, 5, and 7- 9, 11-20.

Please amend claim 3 as follows:

14 S5  
B2 >  
3. (Amended) A semiconductor device wherein a first terminal of an active element is connected via an electrically conductive member to a heat sink member, and wherein a second terminal of the active element transmits heat to said heat sink member via at least an insulating member interposed in between, wherein a void is formed between said conductive member and said insulating member.

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FOI 101  
Please amend claim 10 as follows:

A5 S5  
B3 >  
10. (Amended) A semiconductor device as defined in claim 21 wherein said insulating member is arranged on at least one of (a) a terminal surface of said active element and/or (b) a heat sink member side of the package used for mounting the active element.

Please insert New claim 21:

A6 S5  
B4 >  
~ 21. (New) A semiconductor device comprising:  
a heat sink member having a protrusion formed thereon;  
an active element having a plurality of terminals; and  
an insulating member formed of a single insulating layer on the active element  
and connecting one of the first or second terminals to the heat sink member, the other of the first and second terminals connecting the heat sink member via the protrusion.~

**In the Drawings:**

Attached is a Request for Approval of Drawing Changes accompanying amended drawings showing the changes in red ink.

**REMARKS**

The applicants respectfully submit that the amendment to the specification and the claims represent a clarification of the present invention and that support for the amendments can be found in the application as originally filed.

The "void" which is the basis for the amendments to the claims and the specification, is formed by a space between the Au conductor, which covers the source electrode and the aluminum nitride insulator, which covers the drain electrode. On page 13 of the specification the steps for forming the aluminum nitride insulator on the drain electrode of the active element are recited. Initially, the second insulating layer is etched back to expose the source and drain electrodes. Then aluminum nitride is deposited over the entire chip. The aluminum nitride is then etched so that it only covers the drain electrode. Subsequently there are no further insulating layers deposited on the active element.

Next, an Au plating is applied to the heat sink, and the heat sink Au plating package is then bonded to the active element. As shown in figures 8 and 9 the Au plating (11) has distinctive boundaries. The Au plating is not shown as contacting the aluminum nitride, nor is the plating shown as expanding beyond the surface of the source electrode which it covers. Additionally, in Figure 8 of the application there is an overhead view of the package where the gold plating is shown as approximately the same width as the source electrode which it will have to cover. Accordingly, if the Au plating is approximately the same width

as the source electrode and the aluminum nitride is of a width which only covers the drain electrode there must be something between the two elements which is approximately the same size as the distance between the source and drain electrodes.

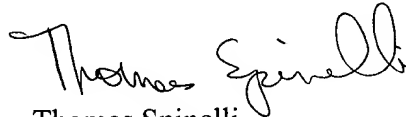
It has been previously stated, but bears repeating that no other layers of material have been applied to the surface of the active element after the etching of the aluminum nitride. As a result of the placing together of the package having the gold plating, and the active element having the aluminum nitride there is formed a void between the two elements which is approximately the same size in length as the distance between the source and drain electrodes.

In light of the foregoing, applicants respectfully submit that from reading the original specification and reviewing the original drawings one with ordinary skill in the art, would understand that the area now designated as 14, to be a void. Accordingly, the positive recitation of the "void" and giving the location of the void a number in the figures does not represent the addition of new matter. Therefore it is respectfully requested that the amendments to the specification and the claims be entered and fully considered during a prosecution on the merits of this application.

Attached hereto is a marked-up version of the changes made to the claims by the current amendment. The attached page is entitled **"VERSION WITH MARKINGS TO SHOW CHANGES MADE"**.

In view of the above it is respectfully submitted that this application is in condition for allowance. Accordingly, it is respectfully requested that this application be allowed and a Notice of Allowance be issued. If the Examiner believes that a telephone conference with the Applicants' attorneys would be advantageous to the disposition of this case, the Examiner is requested to telephone the undersigned.

Respectfully submitted,



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TS/NDW:eg

Enclosures

- (1) Version with Markings to Show Changes Made
- (2) Request for Approval of Drawing Changes

100-1168-12516Z-AMEND-12516Z-AM1